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AUTHOR Ogletree, Earl J.; Etlinger, Leonard E.
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ABSTRACT

Many children are known to leave school with mathematical deficiencies, particularly from the inner city. While manipulatives are generally used to teach and reinforce understanding of operations, concepts, and abstractions, the use of concrete objects is not viewed to fully involve the student in the learning process. A finger system of calculation, recently brought to the United States, is described and promoted as an idea whose "time has come" for implementation in the special education curriculum. Finger calculation, also known as sensory mathematics, finger math, and other names is not seen as a panacea or replacement for the regular mathematics curricula and classwork. It is an introductory reinforcement and supplemental technique. Use of the finger calculation method to learn arithmetic is viewed as supported by Piaget's stages of cognition. Several research studies that indicate finger math is successful in increasing academic achievement are noted. (MP)

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Finger Mathematics for Inner-City School Children

by

Earl J. Ogletree and Leonard E. Etlinger

Many children leave school with mathematical deficiencies. This is particularly true of many inner-city students today. In many cases they do not attain mathematical skills beyond the sixth grade. A major problem appears to be one of methodology, i.e. finding a method of teaching that is concrete and meaningful and compatible to their needs.

Manipulatives are generally used to teach and reinforce understanding of operations, concepts and abstractions. Even though working with concrete objects involves motoric skills, it does not fully involve the student in the learning process. Even the use of manipulatives is more abstract than the direct use of the fingers.

Recently a finger system of calculation was introduced in the U.S. This system, known by various names such as sensory math, fingermath and finger calculation was developed in Korea by Hang Yung Pai.

Basically, finger calculation is a finger manipulative method of performing the four basic operations with whole numbers, utilizing the fingers as a mixed-base abacus. The right hand represents the units place, the left hand the tens place and by means of a systematic

sequence of finger positions one can count to 99. For numbers above 99, the sequence is repeated. Since the system involves psychomotor activity, sense of touch and visual stimulation, it provides a natural bridge between sensory input and intellectual interpretation.

Finger calculation is not a panacea or replacement for the regular mathematics curricula and classwork. It is an introductory reinforcement and supplemental technique. Oral recitation is to be used to accompany the pressing of numbers with the fingers as an integral facet of finger calculations.

Individual oral exercises and choral counting helps to focus the children's thinking and reinforce finger manipulations. It gives the teacher the opportunity to evaluate progress and to correct inappropriate calculation patterns. The multimodes of learning (visual, auditory, oral, touch and psychomotor) using finger calculations provides a natural and compatible media for children of all abilities, including the handicapped. For children with laterality difficulties or poor motor-visual-skills or auditory coordination, finger calculations not only facilitates the learning of mathematical skills, but help to ameliorate the handicapping conditions.

Children best learn mathematical concepts and skills by first experiencing numbers physically, then visually, then emotionally and lastly conceptually. In summary:

Steps in Learning	Finger Calculation
1. Associating number experiences to physical movement.	1. Pressing of fingers.
2. Associating number experiences to seeing.	2. Visual consciousness (watching fingers).
3. Associating number experito feelings and hearing.	3. Individual oral and choral recitation.
4. Associating number experience to thinking.	4. Intellectual interpretation.

Using the finger calculation method to learn arithmetic is supported by Piaget's stages of cognition. The first stage (ages 0-2 years) is the sensory-motor stage in which learning is mainly via psychomotor activity. At the preoperational state (2-7 years of age), thinking is sensory bound. Children are involved in direct perceptual relationships with a minimum of mental reflection. For the most part, they are unable to distinguish between how things look and how they really are. They cannot hold mental images without concrete stimulation or reinforcement. At the concrete operational state (ages 7-14 years), thinking is more operational, pictorial, and free from the senses, but needs concrete support for problem solving.

Analysis of these sequential stages indicates that children have greater voluntary control over the thinking process as it is gradually released from the physical body and dependency on the senses. Therefore, learning is hardly ever a purely cognitive process for children. It includes physical and emotional involvement--interest, motivation and

preference. For effective and efficient learning to take place the methods of teaching and learning must be compatible with the learning style of the children.

Finger calculations appears to meet these criteria because of its psychomotor base. Steiner (1964) agreed with this approach:

> The less we train the intellect directly and the more we aim at treating (teaching) the whole child in such a way that out of motoric activity the intellect will evolve. Learning to think directly through the head is not the kind of learning that will last for young children. The child will become tired and disinterested. But if he has to do actions with his own body which need to be thought out first, this will develop thinking in the proper way. Learning will be facilitated and retention increased. (p.25)

This has some logic. Learning and eventually becoming proficient in a skill is the forgetting of the process. We acquire the ability to write because we have forgotten the process which has sunken into the subconscious. As a result of using finger calculations to facilitate the learning of the four mathematic operations, mathematical skills emerge as an ability because the experience has sunken into the subconscious. Learning finger calculations is similar to learning a musical instrument or learning a sport--skating or skiing -- in that the basic skills of finger calculations must be learned thoroughly before moving on to more complex manipulation skills.

Practice is essential. Although finger calculation is relatively simple, the tempo of the teaching process must be slow to maintain

confidence and motivation. Speed is not to be encouraged.

Finger calculations has become increasingly popular and effective in the United States with all kinds of children, young to older, handicapped to non-handicapped. It has been shown that young children who have learned the finger calculation system can add, multiply, subtract or divide numbers faster than an adult using an electronic calculator. The issue is not the speed in finding answers to problems, but the feasibility and applicability of using finger calculations to enhance arithmetical understanding and skill development of handicapped and non-handicapped children.

Several research studies have shown that the finger calculation method is successful in increasing academic achievement. A study project conducted by the Texas Education Agency (1978) included eleven first and second grade, ten third grade and fourteen remedial fifth grade classes selected on a random basis. An equivalent control group was used. Both groups were given a pretest and a posttest after sixty days of instruction. An analysis of covariance showed a statistically significant difference favoring the experimental groups in many cases.

A later study by Chavez (1980) comparing the arithmetic achievement of twenty-nine Chicago black inner-city second grade students taught by the finger calculation with twenty-seven control group students. After five months of instruction, the finger calculation group scored significantly higher (.05) on the IOWA test in arithmetic than the control group.

Gurau and Lieberthal (1979) found their finger math system to be successful with all children:

> A year of involvement...of both normal and obviously handicapped children has demonstrated...that exposure to finger math techniques is helpful as well as enjoyable for the children (p. viii).

The procedure for teaching finger calculations to socially disadvantaged children does not appreciably differ from those of their middle class peers, except to proceed at a slower rate with more reinforcement. An advantage of finger calculations is that it lends itself to easy diagnosis and individual one-to-one instruction by another student or a sibling or parent at home. Because of its multi-sensory, multi-active approach, it provides many avenues for all children to learn. Activity for children is synonomous with play; play begets motivation, and motivation begets learning. Finger calculation (finger play) is a method "whose time has come" for implementation in the special education curriculum.

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